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**A Edward Scherer**
Manager of Nuclear
Oversight and Regulatory Affairs

October 29, 2002

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: **Docket No. 50-362**
**Second Ten-Year Interval Inservice Inspection Program**
**Reactor Pressure Vessel Examination Relief Request B-2-05**
**San Onofre Nuclear Generating Station Unit 3**

Gentlemen:

This letter requests NRC approval of Relief Request (RR) B-2-05 from the ASME Code requirements for the reactor pressure vessel (RPV) examinations for San Onofre Nuclear Generating Station Unit 3.

The ASME Code Section XI, Subsection IWA-2232, requires ultrasonic testing (UT) examination of the RPV-to-flange weld to be in accordance with ASME Code, Section V Article 4.

In lieu of ASME Section V Article 4, this relief is requested to allow the use of a Performance Demonstration Initiative (PDI) qualified procedure for the UT examination of the RPV vessel-to-flange weld from the vessel side of the weld in accordance with ASME Code, Section XI, Division 1,1995 Edition, 1996 Addenda, Appendix VIII, Supplements 4 and 6 as amended by the Federal Register Notice 64 FR 51370 through 51400, dated September 22, 1999.

This relief request is needed to support the Unit 3 Cycle 12 refueling outage, which is currently scheduled to begin on January 6, 2003.

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A047

If you have any questions or need additional information regarding this matter, please feel free to contact me or Mr. Jack Rainsberry at (949) 368-7420.

Sincerely,

Enclosure

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
B. M. Pham, NRC Project Manager, San Onofre Units 2, and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 & 3

# Enclosure

## San Onofre Nuclear Generating Station
## Unit-3, Second Ten-Year Interval
## Inservice Inspection Relief Request RR-B-2-05

**San Onofre Nuclear Generating Station**
**Unit-3, Second Ten-year Interval**
**Inservice Inspection Relief Request RR-B-2-05**

## I. System/Component for Which Relief is Requested:

ASME Category B-A Pressure Retaining Welds In Reactor Pressure Vessel (RPV), Item No. B1.30 upper shell to flange weld from flange Inside Diameter (ID).

## II. Code Requirement:

ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components 1989 Edition, No Addenda, Subsection IWA-2232, requires ultrasonic testing (UT) examination of the RPV-to-flange weld to be in accordance with ASME Code, Section V, Article 4.

In addition, the NRC has issued Regulatory Guide (RG) 1.150, Revision 1, "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations," which serves as regulatory guidance for the UT examination of RPV welds.

## III. Code Requirement from Which Relief is Requested:

ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 Edition, No Addenda, Subsection IWA-2232, requires UT examination of the RPV-to-flange weld to be in accordance with ASME Code, Section V, Article 4. In addition, Regulatory Guide (RG) 1.150, Revision 1, "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations," serves as regulatory guidance for the UT examination of RPV welds.

Relief is requested for San Onofre Nuclear Generating Station (SONGS) Unit-3 for the second 10-year interval ISI scheduled for the January 2003 refueling outage.

## IV. Basis for Relief:

SONGS Unit 3 is required to perform inservice examination of the RPV flange weld in accordance with the requirements of ASME Code, Section V Article 4 and the subsequent guideline requirements of Regulatory Guide 1.150 Rev 1.

Federal Register Notice 64 FR 51370 through 51400, dated September 22, 1999, revised the 1999 Edition of 10 CFR 50.55(a) Codes and Standards. This revision requires that ASME Code, Section XI, Appendix VIII, Supplement 4, Qualification Requirements For The Clad/Base Metal Interface of Reactor Vessel, and Supplement 6, Qualification Requirements For Reactor Vessel Welds Other Than Clad/Base Metal Interface, be implemented for most of the RPV welds by Nov 22, 2000. The RPV vessel-to-flange weld is the only RPV circumferential weld not included in Appendix VIII.

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**Inservice Inspection Relief Request RR-B-2-05 (cont.)**

This relief is requested to allow the use of a PDI qualified procedure to complete the UT examination of the RPV vessel-to-flange weld from the vessel side of the weld in accordance with ASME Code, Section XI, Div. 1, 1995 Edition, 1996 Addenda, Appendix VIII Supplement 4 and 6 as amended by the Federal Register Notice 64 FR 51370 through 51400, dated September 22, 1999 in lieu of ASME Code, Section V, Article 4.

During the upcoming ten (10) year RPV weld examinations, we will be employing personnel, procedures and equipment, demonstrated and qualified by a Performance Demonstration Initiative (PDI) and in accordance with ASME Code, Section XI, Div.1, 1995 Edition, 1996 Addenda, Appendix VIII, Supplements 4 and 6 as amended by the Federal Register Notice 64 FR 51370 through 51400, dated September 22, 1999 for the adjacent welds.

The remote examinations will be performed using the Westinghouse SUPREEM Robot and the Paragon UT data acquisition system in accordance with a PDI qualified procedure. The Westinghouse procedure PDI-ISI-254, "Remote Inservice Examination of Reactor Vessel Shell Welds," in accordance with ASME Code, Section XI, Appendix VIII, Supplements 4 and 6, was demonstrated at the PDI qualification session in 2001 (Performance Demonstration Qualification Sheet (PDQS) No. 407). The procedure complies with ASME Code, Section XI, Appendix VIII, 1995 Edition, 1996 Addenda as modified by the final rule.

Appendix VIII was developed to ensure the effectiveness of UT examinations within the nuclear industry by means of a rigorous, item specific, performance demonstration. The performance demonstration was conducted on a RPV mockup containing flaws of various sizes and locations. The demonstration established the capability of equipment, procedures, and personnel to find flaws that could be detrimental to the integrity of the RPV.

Although Appendix VIII is not a requirement for this weld, the qualification process to Appendix VIII criteria demonstrates that the examination and evaluation techniques are equal or surpass the requirements of paragraph IWA-2232, "Ultrasonic Examination" of Section XI of the ASME Code and the guidance in RG 1.150.

A comparison between the ASME Code, Section V, Article 4 based UT methods and the procedures developed to satisfy the PDI/Appendix VIII can be best described as a comparison between a compliance-based procedure (ASME Code, Section V, Article 4) and a results-based procedure (PDI/Appendix VIII), (see attached Table 1). ASME Code, Section V procedures use an amplitude-based technique and a known reflector. The proposed alternate UT method was established independently from the acceptance standards for flaw size found in ASME Code, Section XI.

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The PDI qualified sizing method is considered more accurate than the method used in ASME Code, Section V, Article 4. The proposed alternate UT examination technique provides an acceptable level of quality and examination repeatability as compared to the Article 4 requirements.

The PDI Program's PDQS No. 407 attests that Westinghouse procedure PDI-ISI-254 is in compliance with the detection and sizing tolerance requirements of Appendix VIII. The PDI qualification method is based on a group of samples, which validate the acceptable flaw sizes in ASME Section XI. The sensitivity to detect these flaws is considered to be equal to or greater than the sensitivity obtained through ASME Section V Article 4 because the Westinghouse procedure PDI-ISI-254 Code, relies on a smaller scan index and a higher scan sensitivity for the detection of the UT signals.

The examination and sizing procedure uses echo-dynamic motion and tip diffraction characteristics of the flaw instead of the amplitude characteristics required by ASME Code, Section V, Article 4. The search units interrogate the same examination volume as depicted by ASME Code, Section XI, Figure IWB 2500-4, Shell-to-Flange Weld Joint.

The use of procedures for satisfying the requirements of ASME Code, Section V, Article 4 for the UT examination of the RPV to flange weld from the vessel shell has not received the same qualifications as a PDI qualified procedure.

The PDI qualification specimens are curved vessel shell plate sections and do not have taper transition geometry. However, the procedure is used to examine reactor vessel shell welds which have taper transitions at weld joints of dissimilar thickness. The PDI qualification for Supplements 4 and 6 allows for examination of material thickness up to 12.3 inches or a metal path distance of 17.5 inches in the case of the 45 degree transducer. This qualified test range bounds a significant percentage of the flange to shell weld examination volume even in the thicker portion above the weld centerline

The weld was examined during pre-service by remote automated inspection in accordance with Section XI. The pre-service examination was performed from the vessel ID surface, using Section XI techniques at 0 degree longitudinal and 45 and 60 degree shear beam angles. Examination from the flange surface was performed using 0, 8, and 19 degree longitudinal. For inservice examinations, during the first interval the weld examination from flange surface was performed in accordance with Section XI using 0, 7, 8 and 13.5 degree longitudinal. The weld ID surface examination was performed using 0, 45, 60, and 50/70 degree beam angles by remote automated inspection in accordance with Section XI and Regulatory Guide (RG) 1.150 Revision 1. No matters of concern were identified during the aforementioned examinations.

The use of Appendix VIII Supplements 4 and 6 for the completion of the RPV vessel-to-flange weld from the shell side (which PDI has qualified) is expected to reduce examination time, which translates to reduced personnel radiation exposure.

Additionally, this relief would allow a smooth transition to the welds adjacent to the RPV circumferential and longitudinal welds (welds B1.11 and B1.12) which do require an examination in accordance with Appendix VIII, Supplements 4 and 6. This would eliminate the need to switch to the different calibrations; procedure and technique required by ASME Code, Section V, Article 4 and Regulatory Guide 1.150, Rev 1. This would result in a reduction in transition time to the different calibration, procedure, and technique required which translates to reduced personnel radiation exposure and is more cost effective.

## V. Alternate Examinations:

The automated shell to flange weld examinations shall be performed using a qualified procedure in accordance with ASME Code, Section XI, Div. 1, 1995 Edition, 1996 Addenda, Appendix VIII, Supplements 4 and 6 as amended by the Federal Register Notice 64FR 51370 through 51400, dated September 22, 1999.

## VI. Justification for the Granting of Relief:

The Appendix VIII criteria was developed to ensure the effectiveness of UT examinations within the nuclear industry by means of a rigorous, item specific performance demonstration. The performance demonstration was conducted on RPV mockups containing flaws of various sizes and locations. The demonstration established the capability of equipment, procedures, and personnel to find flaws that could be detrimental to the integrity of the RPV. The performance demonstration showed that the proposed UT technique is equal to or surpasses the requirements of the Code and the recommendations of RG 1.150. Therefore, there is reasonable assurance that the proposed alternative provides an acceptable level of quality and safety.

The NRC has granted similar relief to Salem Generating Station, Unit 1 (Reference 1), and Comanche Peak Steam Electric Station, Unit-2 (Reference 2)

## VII. Implementation Schedule:

This relief is requested for the SONGS Unit 3, second ten-year inservice inspection interval.

## VIII. References:

1) Letter from J. Clifford (NRC) to H. W. Keiser (PSEG Nuclear) dated May 3, 2001; Subject: Salem Nuclear Generating Station, Unit No.1-Relief from ASME Code Requirements Related to the Inservice Inspection Program, Second 10-Year Interval, Relief Request RR-B11 (TAC No. MB1234)

2) Letter from Robert A. Gramm (NRC) to C. Lance Terry (TXU Generation Company) dated April 16, 2002; Subject: Comanche Peak Steam Electric Station (CPSES), Unit-2, Re: First 10-Year Inservice Inspection (ISI) Interval Request for Relief from the Requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) concerning Relief Requests A-4, Revision 1; A-5, Revision 2; A-6, A-7 and A-8 (TAC NO. MB3039).

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# TABLE 1

## Comparison Of Reactor Pressure Vessel Shell Examination Techniques

| Description (Code Reference) | ASME Section V, Article 4, 1989<br>ASME Section XI, 1989<br>NRC Regulatory Guide 1.150, Revision 1 | Westinghouse Examination Procedure PDI-ISI-254, Revision 5 |
|---|---|---|
| Examination Angle | Section V, Article 4, T-441 requires the volume of weld and adjacent base material to be scanned by straight and angle beam techniques. Two angle beams, having nominal angles of 45 and 60 degrees with respect to a perpendicular to the examination surface, shall generally be used. Other pairs of angle beams are permitted provided the measured difference between the angles is at least 10 degrees. | Examinations are conducted with three transducer types applied four directionally. Each transducer type has responsibility for interrogation of a specific depth range. The base material directly underneath the cladding to a depth of 2.5 inches is examined by the 45 degree dual element transducer at 4 MHz. From 2.5 inches deep to a depth of 60% of the component thickness, the qualified transducer is the 45 degree L wave, single element at 4 MHz. For examination of vessel shell material from 60% thickness to the OD surface, a 45 degree single element transducer at 2 MHz is used.<br><br>These examination angles/ transducer types were successfully qualified under PDI protocol using the PDI program test blocks. |
| Instrument Calibrations | Section V, Article 4, T-431 requires that instrument screen height and amplitude linearity be evaluated at least every three months.<br><br>Section XI, IWA-2232 requires that these screen height and linearity checks be performed at the beginning and end of the weld examination performed on a vessel during one outage. | Instrument screen height and amplitude linearity are checked prior to and following completion of the examinations of the SONGS Unit 3 reactor vessel. |
| System Calibrations | Section V, Article 4, T-432 requires that the original system calibration be performed on the Code basic calibration block.<br><br>T-432 allows the use of different types of reference blocks and electronic simulators to perform system calibration verifications. | Calibrations are established on a clad calibration block made from reactor vessel material. The block has side drilled hole reflectors at depths throughout the examination volume which are used for range adjustment and calibration sensitivity. |

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**TABLE 1**

**Comparison Of Reactor Pressure Vessel Shell Examination Techniques**

| Description (Code Reference) | ASME Section V, Article 4, 1989<br>ASME Section XI, 1989<br>NRC Regulatory Guide 1.150, Revision 1 | Westinghouse Examination Procedure PDI-ISI-254, Revision 5 |
|---|---|---|
| Scanning Sensitivity | Section V, Article 4, T-425 permits scanning to be performed at the reference level when electronic distance-amplitude correction (DAC) is used with automated recording. | Scanning is performed at the reference level. |
| Recording Level | Section V, Article 4, T-441 requires recording and evaluation of reflectors that produce a response equal to or greater than 50% DAC.<br><br>Regulatory Guide 1.150 requires recording and evaluation at 20% DAC for the inner 25% of material thickness | Per PDI-ISI-254, any indication suspicious of being a flaw, regardless of amplitude, shall be measured for through-wall and length and assessed in accordance with the acceptance criteria set forth in Section XI, IWB-3000. The procedure sensitivity level compares to an ASME Code level of 5-10% DAC. |
| Scan Index and Pulse Repetition Rate | Section V, Article 4, T-425 requires each pass of the search unit overlap a minimum of 10% of the transducer piezoelectric element dimension perpendicular to the direction of the scan.<br><br>Section XI, IWA-2232 requires each pass of the search unit overlap at least 50% of the transducer piezoelectric element dimension perpendicular to the direction of the scan.<br><br>NRC Regulatory Guide 1.150 requires a 25% maximum overlap for detection and 0.25-inch maximum increments for sizing. | A scan index of 0.50" is used for flaw detection and measurement. This index size was satisfactorily demonstrated in the Westinghouse Appendix VIII procedure demonstration. |

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**TABLE 1**

**Comparison Of Reactor Pressure Vessel Shell Examination Techniques**

| Description (Code Reference) | ASME Section V, Article 4, 1989<br>ASME Section XI, 1989<br>NRC Regulatory Guide 1.150, Revision 1 | Westinghouse Examination Procedure PDI-ISI-254, Revision 5 |
|---|---|---|
| Flaw Sizing and Evaluation | Section V, Article 4, T-441 requires amplitude based sizing at 50% DAC.<br>Section V, Article 4, T-451 permits evaluation to alternative standards. | The through-wall size of flaws is determined by the recognition and measurement of diffracted signals from the upper and lower extremes of the flaw. The length is determined by adding the number of scan sweeps exhibiting similar features. This measurement technique was successfully demonstrated in accordance with the rules of Section XI, Appendix VIII, Supplements 4 and 6 as modified by the Final Rule. |
| Procedure qualification and data analyst | N/A | The remote examinations will be performed using the Westinghouse SUPREEM Robot and the Paragon UT data acquisition system in accordance with a PDI qualified procedure. The Westinghouse procedure PDI-ISI-254, "Remote Inservice Examination of Reactor Vessel Shell Welds," in accordance with ASME Section XI, Appendix VIII, Supplements 4 and 6, was demonstrated at the PDI qualification session in 2001 (Performance Demonstration Qualification Sheet (PDQS) No. 407). The procedure complies with ASME Section XI, Appendix VIII, 1995 Edition, 1996 Addenda as modified by the final rule.<br><br>According to procedure, the person performing these tasks must possess individual PDI certification attachments indicating qualification to requirements of Appendix VIII, Supplements 4 and 6 for detection, length, and depth sizing. Examiners are allowed to work only within the scope of their qualifications. |

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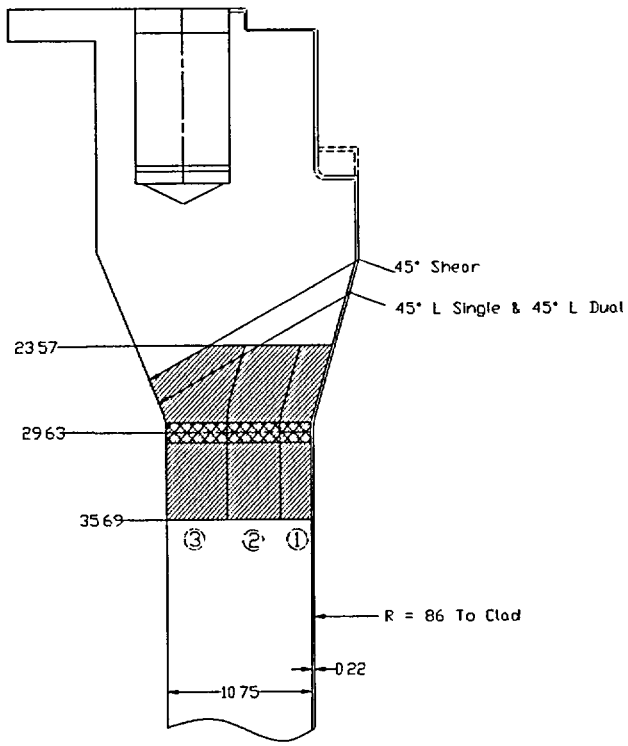
**TABLE 1**

## Figure 1

**Downward facing scans**




① Dual 45° - Entry surface to 25'
② Single 45°L - 25' to 06T
③ Shear 45° - 06T to T

Note Inspection Zones as defined by qualified Procedure PDI-ISI-254

Area Examined

**San Onofre Nuclear Generating Station**
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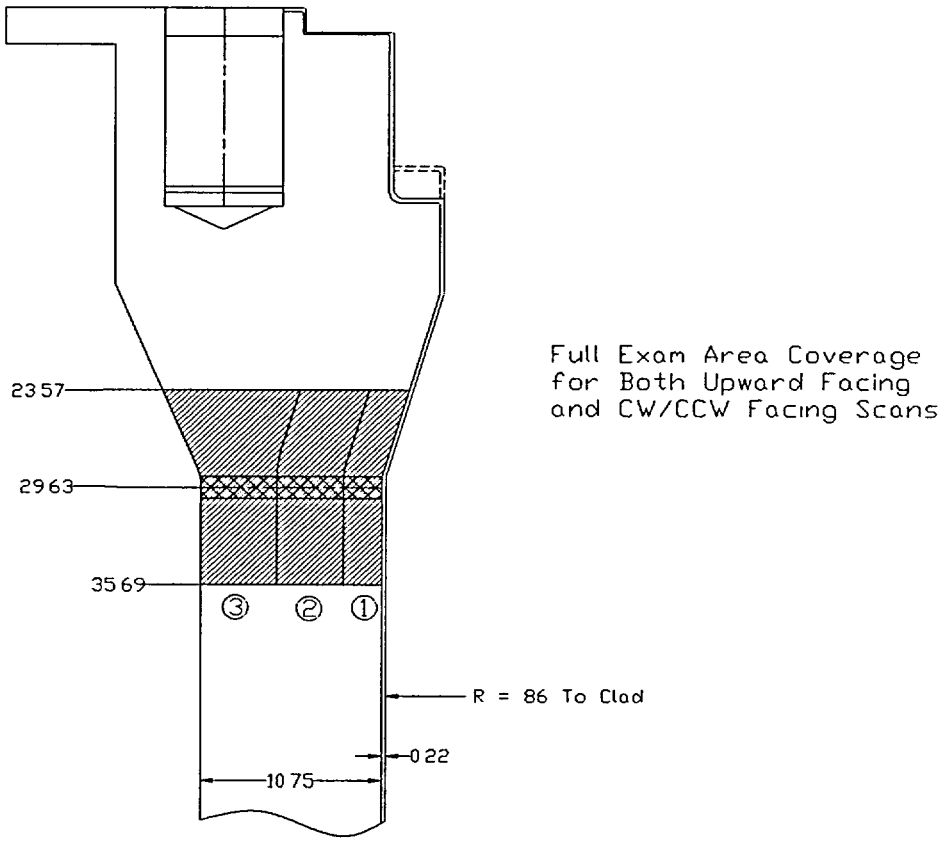
**TABLE 1**

**Figure 2**
**Upward Facing and CW / CCW Scans**




① Dual 45° - Entry surface to 2.5"
② Single 45°L - 2.5" to 0.6T
③ Shear 45° - 0.6T to T

Note: Inspection Zones as defined by qualified Procedure PDI-ISI-254

Area Examined